Low-Cost Computer Graphics

A budget-conscious guide to creating video images with a microcomputer

by David Allen

Using computers to produce graphics for television productions is certainly not a new idea. For at least 10 years we have seen very sophisticated and effective ways to generate graphics (including that specialized breed of graphics called animation) that can be used in television productions. And each year brings with it greater quality and variety, as we can see from the offerings at the annual NAB. Not only television but also the motion picture industry aggressively applies this new technology to the business of visual entertainment and information.

There is, however, one severe handicap that restricts widespread application of these techniques. They require very expensive hardware and highly skilled people to operate it. The lustrous developments at the high-priced end of this industry have outshone many equally exciting things happening at much lower levels of hardware cost. Many of the advantages of computer imaging can be had with very modest budgets if the television producer can accept the discipline

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imposed by less extravagant hardware. What follows is an examination of some inexpensive ways to generate computer graphics.

Two Approaches to Computer Graphics

Before we proceed you should note that there are two ways in which computer graphics can be made a part of a television production: electronically and optically.

Electronic integration. Since computers most often generate a television screen image in much the way a camera does, it makes sense to think of employing the computer as just another camera input to the production. Unfortunately, some severe corners were cut by virtually all designers of inexpensive microcomputers, which make the computer video image incompatible with regular NTSC television signals. To overcome this incompatibility, some special circuitry has been devised for some of the available microcomputers which have good graphics capabilities. To date, only two microcomputers, the Sony SMC-70 and the Apple II, have appeared on the market with this capability ready to use.

A number of peripheral companies have produced signal modification accessories for the Apple II, in both its "plus" and "e" versions. Of the several compan-

ies which have ventured into this area, only two, Adwar, in New York, and Video Associates Labs, in Austin, Texas, have actually demonstrated a marketable product. Of these two, only the Video Associates Labs' Microkeyer has demonstrated an ability to synchronize the Apple II signal with virtually any kind of external video signal, including un-timebase-corrected videotape. For this reason, the Microkeyer appears to have a virtual monopoly on this application of the Apple II. Some of the Apple II "clones," such as the Franklin ACE 1200 computer, have been successfully married to the Microkeyer, although neither manufacturer makes any statement suggesting this possibility.

The Sony SMC-70, available from Sony Communications, is the other computer currently available that can generate a video signal electronically compatible with television production. This computer in its SMC-70G configuration, and with an NTSC superimposer accessory, can mix its signal with any other external NTSC video signal.

Prototypes of other combinations of computers with signals modified for synchronizing with external video have been demonstrated. Video Associates Labs has shown an Atari 800 working with such modification. And Sharp Cor-

poration, from Japan, has shown its X-1 computer with this capability. Neither of these is currently being offered for sale and, in fact, the Atari 800 is being discontinued. The most promising forecast for additional microcomputer genlocking is from Video Associates Labs, which has completed the design of a Microkeyer for the IBM PC computer. It will be available on the market as soon as Video Associates Labs concludes a special marketing arrangement with IBM.

So, for electronic integration of microcomputer graphics into television production, there currently remain two options: the Apple II or the Sony SMC-70.

Optical integration. It is possible to make use of microcomputer graphics *without* having the ability to connect the computer signal and the television signal. To do this one can either aim a studio camera at an isolated monitor displaying the computer graphic information or print out the computer graphic on a paper display, which can then be mounted in front of a studio camera.

There are many printers that will print a graphic on paper available for use with computers. Most of them reduce the graphic to a black-and-white image, even though the original may have contained many colors. An American company, IDS, has produced a paper printer called the Prism, which will duplicate four-color printing. Even more effective can be the use of plotters, devices which use conventional colored pens to draw the graphic image on a piece of paper fastened to an easel or drum. The Strobe 200 is such a plotter.

Of course, using paper printouts precludes the use of the computer's animation capability. This is a severe restriction and one strong reason to invest in the hardware necessary to synchronize signals.

The only advantage that optical integration has over electrical signal integration is cost. A basic microcomputer, such as the Apple II or the Sony SMC-70, will

cost between $2,000 and $3,000 by the time you include the normal accessories such as disk drives and printers. The electronics which enable the computer image to be mixed with a television signal add another $1,500 to $2,500. This means that the least expensive way of generating computer graphics which can be mixed with another television signal will cost around $5,000 for the computer hardware. If one elects only to use computer graphics that are optically integrated into a television production, then a hardware cost around $3,000 can be anticipated.

Computer Graphics Accessories

Since the Apple II is the only computer that has been around long enough to have a significant heritage of accessory devices and software for graphics generation, let's examine some of the ones that make a microcomputer very useful around a television production studio.

The KoalaPad. Almost as soon as the Apple II computer appeared there followed a graphic tablet. The original graphic tablet sold by Apple Computer was a large, easel-like affair, 18 inches on a side, connected, via a small cable, to the inside of the computer. There was also a small stylus, connected by its cable, with which one could draw on the easel and have the results displayed on the video

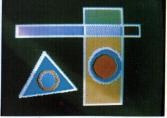KoalaPad touch tablet and software.

screen. This first tablet was moderately expensive at around $850. It was soon followed by the VersaWriter tablet, which contained an elbow-like drawing arm used for creating the images. This tablet was less than half the price of the original Apple Graphic Tablet.

Now there is a very inexpensive and effective replacement for both. It is called the KoalaPad, from Koala Technologies in Los Altos, Calif. The pad itself resembles the old magic slate upon which you could draw with a stylus and then erase by merely pulling up the plastic sheet covering the pad. The KoalaPad works in much this fashion, except the results of drawing on the pad are displayed on the television monitor. While the KoalaPad comes with a dull stylus for writing on the pad, it is possible to do even detailed drawing with just your fingernail. The KoalaPad comes with artistic software on a 5¼-inch floppy disk. With nothing more than the Koala-Pad and its software one can create very sophisticated, multicolored images. The KoalaPad connects to an Apple II computer through the game controller socket. The price of the KoalaPad and the Micro Illustrator software is only $125.

Among the advantages of using computers to draw the graphics for television production is the speed with which they can produce certain otherwise time-consuming graphic events. Straight lines, boxes and circles—filled or empty—can often be drawn faster than they can be described. The abstract images below were drawn in less than one minute using the KoalaPad. That includes the time for coloring the figures. When you unexpectedly find you need a graphic in a television production, the computer can produce a professional graphic image in far less time than it would take a graphic artist to do a conventional rendition. In most cases the computer techniques demonstrated in this article can be accomplished by anyone, regardless of artistic ability.

Koala Micro Illustrator software menu screen.

Abstract images created with KoalaPad.

Figure 1: Art card under camera.

Figure 2: The rough dithertized image.

Dithertizing Your Way to Low-Cost Graphics

Figure 3: The finished dithertized image.

"Dithertizing" is a word which comes from the vocabulary of Bell Telephone Laboratories, where the idea was first developed. The process of creating conventional graphics for television involves some artistic creation on paper or an art card. While it is possible to draw a graphic image right into the computer memory using a number of different electronic graphic tablets, it is much faster to take rough or finished artwork and enter it directly into the computer via a television camera. This is what the dithertizing process does.

In figure 1 you see a small card on the easel of a photo copy stand. A television camera is on the stand. This black-and-white camera picks up the image from the card and sends it to the dithertizing electronics, which are contained on a small electronic plug-in card installed inside the Apple II+ computer. It is this card that does the work. Figure 2 shows the resulting video screen image as captured by the camera and converted by the dithertizer card into a computer image. This rough image may then be subject to editing using a device no more exotic than a computer joy stick and an inexpensive software program, such as Bob Bishop's Micropainter from DataSoft.

The editing process allows even an artistically inexperienced person to edit out those portions of the dithertized image that may have been imperfectly rendered by the pro-

cess. It is also possible to modify or add to the rough dithertized image and so construct a graphic substantially different from the original. Figure 3 shows a final edited image of the telegraph key.

The total time required to carry this process from capturing the image with the television camera on the photocopy stand to the final edited image shown here was approximately one hour. Not bad for a person with no notable artistic skills.

The dithertizer accessory for the Apple II+ is from Computer Station in St. Louis. The Dithertizer, including a small black-and-white camera, is only $650. The editing software from DataSoft in Sepulveda, Calif., with an appropriate joy stick will cost less than $100.

A dithertizing camera can also be pointed at a normal three-dimensional scene and the image dithertized with interesting results. This is the effect often used to create camera portraits for rendering onto T-shirts or other cloth surfaces. Dithertizing is a process that deserves attention from television producers, since it offers fast development of logos and other special graphic characters with very modest hardware cost.

—D.A.

Character generation. As a character generator the microcomputer (Apple II or SMC-70) is outperformed by just about *any* character generator currently sold for that exclusive purpose. But the value of using an Apple II or SMC-70 for this task lies in their ability to perform other computer roles when character generation is not required, and to perform other graphic functions, such as graphing, cartooning and animation, as well. These additional functions are not in the repertoire of conventional character generators.

You should note, however, that the ordinary computer text screen employed in most computer tasks is ill suited for character generation in television production. This is because the 40- or 80-character line normally used by most computers in their text screens becomes very difficult if not impossible to read

]APPLE: Pack my box with five dozen liquor jugs. ABCDEFGHIJ
]BLOCK: Pack my box with five dozen liquor jugs. ABCDEFGHI
]STENCIL: Pack my box with five dozen liquor jugs. ABCD
]WESTERN: Pack my box with five dozen liquor jugs. ABCD
]SMALL SQUARE: Pack my box with five dozen
]SMALL STANDARD: Pack my box with five dozen

Characters available from Apple Mechanic.

when keyed over an external video signal. To solve this problem, special character generator programs have been written which use the graphic screen, rather than the usual text screen, for this function. When so used, the smallest useful characters can fit 20 characters per line, with 12 lines per screen. Here

are some programs which can enable the Apple II computer to emulate a character generator.

Apple Mechanic. This program, from Beagle Bros. in San Diego, Calif., allows the user to type various lines of text using many different font styles and sizes. The letters are very attractive and are proportionally spaced, which means that the "i" and "w" take up differing horizontal space. This creates very pleasing print but is sometimes difficult to manipulate, particularly in center justification. The program is quite inexpensive ($29.50) and is one of several low-priced programs for Apple II graphic manipulation. There is a companion program called Frame-Up, also available for $29.50. This program enables the display of graphic screens, as created by Apple Mechanic or other programs, in a slide-show fashion.
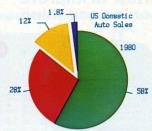
Another image created with KoalaPad.

Figure 4: Pie chart plotted by Strobe from GrafTalk software.

Chargen. Chargen has been written with the television producer in mind. It enables the creation of a series of graphic screens, each with a different combination of text and graphics. The screen series can then be displayed in sequence as called for in a television production. This program uses two character sizes; one size is 10 characters per line, six lines per screen, while the other is 20 characters per line, 12 lines per screen. There is one font available in the large size, but there are several available in the smaller size.

Alphanumerics from Chargen program.

The Strobe 200 plotter.

This program provides for right, left or center justification of text with a different font style possible on each line. The program also allows you to add text to previously created graphics. There is a built-in display program that features manual call-up of each graphic frame as needed in a television production. The program will also permit an automatic display for use in billboard applications. The program is priced at $125 and is available from Boston Media Consultants in Scituate, Mass.

Graphs and plotters. Finally, let's look at specialized graphing functions, with microcomputers. There are many software packages for the Apple II, which can create just about any kind of graph imaginable. Bar graphs, line plots, pie charts and many more are possible. The more sophisticated programs allow the user to enter the numerical values of the information for which a plot is desired

and the program does the rest.

Among the things the computer will perform automatically are scaling the graph, colorizing the plot, comparing different sets of data and so on. The result of all this computer activity can be a video screen of the plot, a black-and-white paper printout from an inexpensive dot-matrix printer, or a high-quality multicolor paper plot prepared by one of the high-quality plotters available.

Figure 4 shows an example of the output of a particularly complete plotting program from Redding Group, in Ridgefield, Conn. This program is called GrafTalk. The version of this program I examined for this article was formatted for the Sony SMC-70 and for plotting by

Let your imagination run free.

the Strobe 200 plotter.

The program allows the user to enter raw statistical data and have the program turn it into a useful graph. This can be a bar chart, pie chart, or line and symbol plot. In addition, the program provides for limited manipulation of the input data in much the same way as spread sheet programs, such as VisiCalc, perform. When the user is satisfied with the plot as seen on the video screen it can be transcribed, in color, to the plotter. The price of GrafTalk is $450.

The Strobe 200 plotter, from Strobe

Graph plotted by Strobe.

Inc., in Mountain View, Calif., represents a price breakthrough in these devices. Plotters have generally been priced above the $1,500 level, but the Strobe plotter is only $695 equipped to perform with the Sony SMC-70 computer. At this lower price some of the automatic features, such as pen selection, are done manually, but this in no way affects the quality of the plot. It just takes a little more time to change pen colors manually.

This has been a survey of some of the hardware and software that will allow you to use your microcomputer to produce graphics for TV production. The field is growing rapidly; I expect to see more systems on the market shortly and will keep you apprised in my Hands On column. There's no reason to wait, however. With the products now available you can produce low-cost, quality graphics with your microcomputer today.